

Learning from Combat-Training Centers: Lessons in Small Unmanned Aerial Systems Employment for High-Intensity Conflict at Squadron Level

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Two Ukrainian mechanized battalions were destroyed July 9, 2014, by an intense artillery barrage near the town of Zelenopillya.¹ The battalions had been observed, identified and targeted through the use of small drones. Independent analysis later assessed that BM-21s sitting nine kilometers away had launched the bombardment.

The Ukrainian losses were devastating and sent a shock through the country's political and defense establishment. This event, together with the Russian invasion of Crimea, served as a wake-up call to many in the U.S. government and military that the threat of high-intensity conflict was back in earnest.

In Europe, the Joint Multinational Readiness Center (JMRC) rapidly adapted to account for this threat by emphasizing small unmanned aerial systems (SUAS) threats and massed artillery fire in its training scenarios. However, one persistent trend JMRC has observed over the past three years is that rotational training units (RTU) have struggled to respond to this training stimulus.²

In early 2017, as 2nd Squadron, 2nd Cavalry Regiment, prepared for deployment to the Suwalki Gap as the first North Atlantic Treaty Organization (NATO) enhanced-forward-presence (eFP) battle group – established to deter aggression on NATO's eastern flank – the unit knew from two recently completed JMRC rotations that, like the RTUs, the squadron's SUAS capability was not performing adequately relative to the threat. During mission analysis, it became clear that in the event of a crisis, 2/2 Cav would be the first element in contact and would have to fight without brigade intelligence, surveillance and reconnaissance (ISR) support.

The unit made the critical realization, informed by the Ukrainian experience and underscored by the lethality of the opposing forces (OPFOR) at JMRC, that high-intensity conflict required different organizational arrangements for SUAS than the counterinsurgency (COIN) fights the Army has been in for the last decade-and-a-half. By adapting employment concepts and organizational constructs, and using lessons-learned from JMRC rotations, 2/2 Cav consolidated its SUAS and created an effective reconnaissance, surveillance and target-acquisition capability during the eFP deployment. This experience led to valuable lessons-learned that can benefit other units in both combat-training center rotations and future deployments.

SUAS in COIN vs. high-intensity conflict

By early 2017, 2/2 Cav had recently completed two JMRC rotations – Allied Spirit 4 and Allied Spirit 5 – separated by a four-month deployment to the Baltic states as part of Operation Atlantic Resolve. Based on the unit's experience at Allied Spirit 4, the squadron established a sustained command emphasis on SUAS. By Allied Spirit 5, the number of trained operators had dramatically increased, and during the rotation, the unit's SUAS flight hours were substantially higher. Yet the squadron still did not achieve the desired effects for reconnaissance and intelligence collection (IC).

It became clear there was a gap between the capability of the systems and the way they had been employed, in particular the RQ-11B Raven. The Raven is a line-of-sight (LoS)-controlled aircraft that can range up to 10 kilometers and has a 60-90 minute flight time. It can be hand-launched and then recovered through a crash landing from nearly any open area. It has a stabilized camera that provides a 10-digit grid to the center of the field of view and can transmit this view to the operator and any One-Station Remote Viewing Terminal (OSRVT) in range. The Raven can operate in visibility and ceiling requirements that would ground larger platforms, such as the Shadow. Finally, the Raven flies so low and has such a small radar cross-section that it's less vulnerable to air defense. In sum, Raven is a highly mobile system that, in decent weather, and a contested environment, can provide quality full-motion video and targetable data anywhere within 10 kilometers of the user.



Figure 1. An RQ-11B Raven, an SUAS employed by 2/2 Cav, is launched by a Soldier in Iraq. (U.S. Army photo)

Despite its advantages, in practice, 2/2 Cav had not been able to fully leverage this capability. During Allied Spirit 4, Operation Atlantic Resolve, Allied Spirit 5 and the early days of the deployment to Poland, troops managed their own SUAS system training and employment. This is the established practice for how to use the RQ-11B Raven system as described by journal articles in *Infantry* and *ARMOR* magazines.³

This is understandable after the Army's COIN experience over the past 15 years. Having a Raven at an isolated outpost was the only way for a company-level formation to have its own reconnaissance asset at isolated combat outposts in Iraq or Afghanistan. Battalions could rely on abundant theater-level ISR for whatever collection they needed.

However, the operational environment and threat are different today. In the case of 2/2 Cav, the squadron would fight together in a relatively compact front, and the contact with enemy forces would be a matter of days, not months. Troop-level UAS doctrine and practice simply did not suit the requirements for the squadron in the "new" high-intensity environment.

Consistent with prior practice, 2/2 Cav's troops all located their Raven system within their troop command post (CP). But their CPs were usually located in a covered and concealed position to increase survivability. This negated two of the features Raven teams needed: an open area for launch and recovery, and terrain that provided good LoS to their target area. Also, having the Raven system at the troop CPs added another link in the chain of reporting, delaying the reaction to whatever the Ravens observed.

The upshot for the squadron was that the troops' Ravens were always included in the squadron IC plan, but little was expected or received from them because they were rarely airborne and rarely reported. The squadron needed to change the organization of SUAS systems to fully exploit the Ravens' capabilities.

Consolidation

The solution was to consolidate the management of SUAS teams at the squadron level for training and exercises. The 2/2 Cav created a SUAS section consisting of two SUAS teams, each equipped with a ground-control system (GCS), multiple RQ-11B airframes and multiple SUAS operators. Each team would have four Soldiers and a humvee with enough communications capability to talk on the squadron command and fires net.

When the squadron deployed for exercises, the team would be tasked directly by the S-3 based on the IC plan the S-2 had developed. The team would then be controlled via the squadron fires net by the squadron fire-support

officer (FSO). The goal of consolidation was to fully leverage 2/2 Cav's SUAS systems to be able to answer priority information requirements (PIRs) and provide observation for sustained and accurate fires on enemy forces.

This consolidation solved several problems. The largest problem was location. As with almost every system that every army has ever used, terrain is the biggest employment consideration. The establishment of separate teams gave 2/2 Cav's SUAS the flexibility and mobility to fly from the best location to have LoS on their airframe as it surveilled the target and to be able to launch and recover their airframe. This was achieved without putting the troop CPs at risk and eroding the troop commander's ability to fight.

It also solved the problem of communication. By establishing them as a separate entity with a direct link to squadron fires, the reporting chain was flattened. This increased visibility of what the SUAS was seeing and increased the speed at which the asset could be used to answer PIRs and acquire targets.

The consolidation of the SUAS systems at the battalion/squadron level went against established doctrine and the way Ravens had been employed in combat for more than a decade – since their fielding in 2006. The move also deprived company/troop commanders of a critical reconnaissance capability as well as badly needed manpower. There would be disadvantages and unintended consequences. Consolidation was a good idea on paper, but 2/2 Cav needed to test the concept in practice to justify the downsides.

Testing

In May and June 2017, 2/2 Cav participated in two NATO exercises in close succession: Puma 17 and Saber Strike 17. Both exercises included a force-on-force (FoF) exercise against host-nation units playing the OPFOR, one in Poland and the other in Lithuania. These exercises provided the perfect opportunity for 2/2 Cav to test the concept of a squadron SUAS section.

Puma 17 was a four-day FoF. Each night the squadron held an ISR synch meeting to allocate airspace and discuss the collection plan. The S-2 provided an update on the enemy situation and anticipated course of action (CoA) for the next day. The squadron S-2 and FSO deconflicted airspace and time, and the S-2 then briefed the IC plan to the SUAS teams. When the teams understood their airspace, named areas of interest (NAI), what indicators they were looking for and their flight times, they departed and prepped for their mission.

At this point, 2/2 Cav was not as comfortable assuming risk in where the SUAS teams were deployed, so they stayed within one to two kilometers of the squadron tactical-operations center. This prevented them from getting into the fight in the initial phase of the FoF. In the latter half of the FoF, the fight moved closer. Following the IC plan, the SUAS team using the RQ-11B Raven conducted a seven-kilometer sortie and found two companies of *Boyeva Mashina Pekhoty* (BMPs) and one platoon of T-72s. The enemy had consolidated after the previous day's actions in preparation for continuing the attack the next day. This answered the PIR about enemy composition and disposition and then allowed the squadron to call for fire and have significant effects on the enemy force.

In Saber Strike 17, 2/2 Cav deployed a squadron (-) task force from Poland to Lithuania to participate in a two-day FoF. The task was to conduct a guard on the perimeter of a wet gap crossing. The 2/2 Cav's area of operations was a small piece of a 30 kilometer x 50 kilometer maneuver-rights area in central Lithuania. The squadron S-2 rapidly developed enemy CoAs (ECoAs) based on the brigade S-2's products and then an IC plan. The squadron staff then coordinated with the brigade to open a restricted operating zone for UAS operations.



Figure 2. British, Romanian and U.S. Soldiers discuss operating procedures for their eFP battle group during the defensive phase of the multinational field-training exercise that was part of Saber Strike 17 in Bemowo Piskie, Poland, June 14, 2017. Saber Strike is a U.S. Army Europe-led multinational combined-forces exercise conducted annually to enhance the NATO alliance throughout the Baltic region and Poland. (U.S. Army photo by SGT Justin Geiger)

The squadron SUAS section, now equipped with one RQ-20 Puma, then deployed to good local terrain that facilitated LoS to their tasked NAI. The next morning the UAS team launched their airframe and conducted an 11-kilometer, 90-minute sortie. On this sortie, they observed an enemy BMP platoon at the NAI they were tasked with. This confirmed the ECoA, provided early warning for the troop commander who was deployed forward and allowed 2/2 Cav to request brigade fires to destroy the enemy platoon.

Saber Strike and Puma demonstrated that consolidating UAS worked. In two exercises with different OPFOR and different terrain, the UAS section achieved the desired effects. The UAS section was able to effectively follow the IC plan, answer the commander's PIRs and perform as a highly effective observer for accurate fires.

Refining solution

After 2/2 Cav validated consolidation, the next step was to man, train and equip the UAS section appropriately. The squadron manned the section using two Raven master trainers and six soldiers from the rifle and headquarters troops who were mission-qualified Raven operators. The section then acquired two more pieces of custom equipment. The first was an extendable mast to raise the antenna's height. Through experimentation in different types of terrain, it became clear that being able to raise the directional antenna three to five meters in the air would increase link quality at extended ranges.

The second piece of custom equipment was a power converter. This allowed the teams to charge the UAS airframe battery and the GCS battery while flying. Initially, charging batteries pre-mission was enough, but once teams became more proficient and began to run near-continuous flying operations, charging during missions became necessary.

The squadron also coordinated more specialty training: fire-support coordination exercises (FSCXs) to integrate with squadron and troop fires, and weekly proficiency flights with specific goals. The UAS operators conducted a week-long call-for-fire class with the squadron FSO, using the Call for Fire Trainer so all the UAS operators would be capable of acting as an observer for fires.

The squadron also had the UAS operators attend the company-intelligence-support team class to give them a better understanding of IC and the threat. This specialty training helped develop a better understanding of the fight for the junior infantry and armor noncommissioned officers and Soldiers who were assigned as UAS operators.

Next, the squadron developed a training lane with troop FSOs and the UAS section. During the situational-training exercise lane, the troop FSO was in control of the UAS and used it to find and track the “OPFOR” and then call for fire while receiving the UAS video on the troop’s OSRVT. This event in particular helped build the confidence of troop FSOs and the UAS section in their effectiveness and capability.⁴

For their proficiency flights, the teams focused on two specific goals: emplacement time and sortie distance. After every proficiency flight, master trainers were instructed to record the time from when they parked to when their airframe was in the air, and then time on station. The next exercise was to attempt to fly to the maximum range that they could for each sortie (this required booking airspace in advance). These two metrics may not seem important at first blush, but they are the two primary factors that dictate the SUAS team’s effectiveness.

The emplacement-time metric focused the teams on refining and smoothing out their setup so they could do it quickly and efficiently, which meant they were on station faster with less downtime and more consistently. The range forced the team to conduct better microterrain analysis and get in the habit of picking the best ground for their mission. Elevation and trees are huge factors; where the team parked the system with respect to the woodline and elevation dictates how far they can fly.

Final tests

At the end of 2/2 Cav’s deployment to Poland, the squadron conducted a final exercise: Dragon 17. Once again, the UAS section was deployed to support. These teams were immensely successful. In this four-day FoF, they flew 20 flight hours and 31 sorties. They also acted as the observer for 13 fire missions that destroyed more than 20 enemy vehicles. The 2/2 Cav received the team’s reporting over the frequency-modulation net and dynamically retasked them as needed. Furthermore, troop commanders and FSOs received the feed on their OSRVTs and reporting on the squadron fires net. This provided them with better situational awareness and early warning. The team consistently provided timely intelligence to answer PIRs and performed as an effective observer for fire missions.

The final validation of the consolidation of SUAS concept was at Allied Spirit 8, another exercise at JMRC. As the unit prepared for the exercise, it was clear that this would be a much more demanding test of the system. Hohenfels Training Area (HTA) is small (only seven kilometers x 14 kilometers) compared to the Joint Readiness Training Center and the National Training Center but makes up for it with rolling hills and deep valleys that compartmentalize the fight. The small size of HTA also compresses the airspace available, making airspace management a challenge for RTUs. Also, JMRC is home to 1-4 Infantry, U.S. Army Europe’s professional OPFOR. JMRC prides itself on placing RTUs under multiple forms of contact at all times and stressing unit systems to the point of failure.

For the rotation, 2/2 Cav fielded two squadron UAS teams, each with three soldiers; one humvee; a GCS; and Puma and Raven SUASs. Each team was led by one of the Raven master trainers. These teams worked for the squadron and then coordinated with the nearest troop for local security.

Despite challenging weather conditions, 2/2 Cav flew 21 hours during Allied Spirit 8; most RTU battalions fly less than one hour. In comparison, 1-4 Infantry flew 31 hours with their Raven systems.⁵ The section answered PIRs, served as an observer for fire missions and supported maneuver throughout the exercise. Employing the SUAS section during the defense was particularly challenging. Weather on several days restricted the flight of SUAS systems when the OPFOR elements made contact. However, when 2/2 Cav received the OPFOR’s main attack, the UAS section was able to get eyes on the enemy exploitation force and serve as an observer for troop mortars.

In the offense, the SUAS section was much more successful. The UAS section answered the commander’s PIR of determining the enemy’s defensive positions during multiple sorties. UAS observed OPFOR emplacing obstacles in an occupied town, which allowed 2/2 Cav to disrupt this OPFOR activity with indirect fires. The UAS section also pinpointed multiple enemy reconnaissance elements in the unit’s security zone, cued by audible contact from the scout platoon and ground moving-target indicators. This allowed 2/2 Cav to destroy or suppress enemy recon elements and establish a security zone.

The UAS section also identified enemy battle positions oriented on 2/2’s planned avenue of approach. This intelligence changed the squadron’s assessment of the enemy’s defense and change the scheme of maneuver.

Conclusion

Consolidating 2/2 Cav's SUAS platforms as a squadron asset proved successful. It dramatically increased the squadron's ability to conduct reconnaissance and surveillance. The 2/2 Cav became much more effective at concentrating its forces at the decisive point and placing sustained and accurate fires on the enemy. The sacrifice of two to three Soldiers from the troops and the loss of their organic SUAS systems was paid back with an increased capability that benefited the squadron and troop fights.

This would not have succeeded without sustained command emphasis. The creation of this section was not insignificant in resources and time. Without the continued support from squadron leadership, the friction in creating this section could have prevented success.

The echoes of the artillery barrage at Zelenopillya and the Russian invasion of Crimea have caused the U.S. Army to rethink how to prepare for high-intensity conflict. JMRC's commitment to faithfully replicating that threat through the aggressive use of UAS systems and fires have provided an invaluable training stimulus. The 2/2 Cav's experience at Allied Spirit 4 and Allied Spirit 5 drove the unit to innovate and become more lethal. By the end of Allied Spirit 8, 2/2 Cav had definitively turned the tables: the squadron UAS were just as effective as the OPFOR's. The 2/2 Cav would not experience its own Zelenopillya.

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Notes

¹ S. Woodford, "The Russian Artillery Strike that Spooked the U.S. Army," retrieved from *Mystics & Statistics*, a blog on quantitative historical analysis hosted at <http://www.dupuyinstitute.org/blog/2017/03/29/the-russian-artillery-strike-that-spooked-the-u-s-army/>, March 29, 2017.

² LTC Matthew T. Archambault, CPT Franklin G. Peachey, CPT Sean D. Hayball and SSG Drew D. Lincoln, "OPFOR vs. RTU [SUAS] at JMRC," *Infantry*, July-September 2017.

³ CPT John Albert, "A Practical Guide for Excellence in Company Unmanned Aircraft Systems Operations," *ARMOR*, July-September 2016; CPT Christopher J. Colyer, "Tactical Employment of the Raven SUAS," *Infantry*, April-June 2016.

⁴ "Fox FIST and the OSRVT," Oct. 24, 2017; retrieved from Center for Army Lessons-Learned, <https://call2.army.mil/toc.aspx?document=17560>.

⁵ Correspondence with 1-4 Infantry's battalion S-2.

Acronym Quick-Scan

BMP – Boyeva Mashina Pekhoty

CoA – course of action

COIN – counterinsurgency

CP – command post

ECoA – enemy course of action
eFP – enhanced forward presence
FoF – force-on-force
FSCX – fire-support coordination exercise
FSO – fire-support officer
GCS – ground-control system
HTA – Hohenfels Training Area
IC – intelligence collection
ISR – intelligence, surveillance and reconnaissance
JMRC – Joint Multinational Readiness Center
LoS – line-of-sight
MI – military intelligence
NAI – named area of interest
NATO – North Atlantic Treaty Organization
OLC – oak-leaf cluster
OPFOR – opposing forces
OSRVT – One-Station Remote Viewing Terminal
PIR – priority information requirement
RTU – rotational training unit
SUAS – small unmanned aerial system
UAS – unmanned aerial system

Key take-aways

- Squadrons can form a consolidated UAS section for a limited cost that can have outsized effects.
- Sections need their own platform to select good terrain for their mission, have communications with fires and be able to charge batteries.
- Squadron management of UAS is incredibly helpful for managing airspace and ensuring the IC plan is executed.
- Squadron UAS shortens the sensor-shooter linkage and makes the Raven into an effective observer for fires.
- Command emphasis is the single most important factor in the success of SUAS operations.